

REMARKS

Applicant respectfully requests reconsideration and allowance in view of the foregoing amendments and the following remarks. By this Amendment, claims 1, 11 and 18 have been amended. Upon entry of the Amendment, claims 1-22 will be pending in the Application. Applicant reasserts the arguments made in response to previous Office Actions and provides the following additional clarifications.

Rejections under 35 U.S.C. § 103

In the office Action, the Examiner notes that the claims do not explicitly recite rigid point matching. Applicant had previously identified descriptions of rigid point matching in the Specification to promote a better appreciation of the distinctions between the present Application and Wang. By this amendment, and in the interest of advancing prosecution, Applicant has amended the independent claims to explicitly require rigid perturbation of measured point locations.

Applicant initially reasserts that the methods taught in the Wang reference are explicitly applicable to *non-rigid* registration (*see, e.g., Wang* title and page 7, col.1, first paragraph). Applicant respectfully submits that, as reflected in the claims and the Specification, the present Application relates to a system and method providing fast, robust, *rigid* point matching of measured positions to template positions” (page 1, lines 9-12, emphasis added). Therefore, it will be appreciated that present invention provides novel systems and methods that address deficiencies in the cited prior art (*see* Specification page 2, lines 9-12).

Claims 1 and 11 require acquiring measured data representing a set of measured point locations, comparing said set of measured point locations to template/reference data representing a set of template/expected point locations, defining force field vectors operative to perturb said measured point locations into alignment with said template/expected point locations. Claim 1 further requires matching measured point locations to template point locations, responsive to said defining. Claim 11 further requires selective repetition of steps including comparing said measured point locations perturbed by force field vectors and moment arms to said reference data, and redefining said force field vectors and said moment arms responsive to said comparing until predetermined convergence criteria have been satisfied. Wang does not teach or suggest these limitations.

Wang does not teach acquiring measured data representing a set of measured point locations and comparing said set of measured point locations to template data representing a set of template point location. Rather, Wang teaches the use of sets of examples to *generate statistical point models* that can then be used in modeling deformations of objects (Wang, page 9, col. 2, lines 14-33, with emphasis added). Wang further teaches that “[a] Bayesian formulation, based on this *prior knowledge* and *the edge information of the input image*, is employed to find the object boundary with its subset points in correspondence with the point sets of boundaries in the training set.” (Wang, page 10, col. 1, lines 6-10, with emphasis added). Wang further clarifies that its model point sets are not measured but are derived by algorithmic interpolation between hand-marked landmarks. (See Wang, page 10, col. 1, lines 15-23). Nevertheless, in the Office Action, the Examiner equates Wang’s statistically or arbitrarily calculated point sets with the claimed measured point locations. Applicant respectfully submits that hand-labeling of landmark positions, equal-spaced interpolation and algorithmically alignment cannot be equated to measuring. (See Wang at page 10, col. 1, lines 15-24). Therefore, the rejections should be withdrawn because Wang uses *statistically generated points* in a model and *edge information* in an input image to find an object boundary rather than measured point locations and Wang cannot be said to teach or suggest acquiring representing a set of *measured data* representing *measured point locations* as required by the claims of the present Application.

Furthermore, no motivation would have existed to combine and alter the cited prior art in a manner that would have engendered an expectation of successful outcome from such combination and alteration. A skilled artisan reading Wang and the other cited art would have been impressed with the extreme difficulty in measuring point locations in an image where even the boundaries of objects could not be readily discerned and where no template was possible because the shape of the atlas objects was not precisely known. (See, e.g., Wang, paragraph spanning pages 9 and 10 and page 12, col. 1, lines 24-30). Wang teaches the futility of using a template since “[t]here is no true physical model for deformation between individuals...” (Wang at page 12, col. 1, lines 24-30). Consequently, according to Wang, (1) no true template could exist since no uniformity of objects exists and (2) point sets can only be approximated based on statistical methods and sets of examples and accordingly are fictitious points. (Wang at page 12, col. 1, lines 24-30, *and see* page 9, col. 2, lines 14-33). None of the cited art contradicts or ameliorates these teachings. Therefore, Applicant respectfully submits that a skilled artisan would have been unmotivated to combine or alter

Wang and the other cited art with any degree of expectation of a successful outcome in measuring point locations and comparing those measured point locations to template point locations.

Applicant reasserts that Wang does not teach the force field vectors operative to perturb measured point locations into alignment with said template point locations as required in the present application. In the Office Action, the Examiner continues to rely on Wang's vector maps that track feature locations between two images and Ishida's transformation calculations to allege that the prior art renders obvious, elements of the current claims. However, Wang merely teaches deformation of an atlas to cause a model to fit a study image. (Wang, page 7, col. 1, line 10, col. 2, line 13). Such vector maps are taught as describing translational and rotational information and make no reference to force field vectors. Thus, Wang does not teach or suggest the use of force field vectors.

Furthermore, Wang does not teach or suggest rigid perturbation or matching measured point locations to template point locations based on the force field vectors. Wang provides no indication as to how such force field vectors could be defined. Since Wang teaches that "[t]here is no true physical model for deformation between individuals...", Wang cannot be said to render obvious definition of force field vectors to rigidly perturb measured point locations into alignment with template point locations. (Wang at page 12, col. 1, lines 24-30 and *see* Wang at page 7, col. 1, lines 5-9 limiting Wang to non-rigid registration). Additionally, Wang expressly limits its teachings to non-rigid transformation. Therefore, Wang and the other cited arte do not render obvious defining force field vectors to rigidly perturb measured point locations into alignment with template point locations.

Regarding Ishida, Ishida teaches methods of subtracting a history of images to reveal difference objects between successive images and to compensate for differences in a subject's inclination and rotation (*see* col. 2, lines 18-24). Nothing in Ishida teaches or suggests any benefit to be derived from iterative steps to compensate for differences in time-lapsed images where each iteration includes computation of modified probe point locations and redefining force field vectors as recited in claim 18.

Therefore, for at least these additional reasons, Applicant requests withdrawal of the rejections of the claims.

New Rejection of Claim 9

Claim 9 stands rejected in the outstanding Office Action although the Examiner had previously acknowledged that claim 9 contains allowable subject matter. Applicant respectfully traverses the rejection. The new rejection is based on an allegation that “‘selectively’ could be interpreted to mean only calculating at sparse boundary points.” (See OA at page 5, fourth paragraph). However, such interpretation cannot easily be reconciled with the requirement in claim 9 of comparing a *set* of measured point locations to template data representing a *set* of template point locations. In rejecting claim 9, the Examiner has effectively interpreted “set” to mean “selected ones of a set.” Applicant respectfully submits that such claim construction is improper and consequently requests withdrawal of the rejection.

Allowable Subject Matter

Applicant thanks the Examiner for acknowledging the Allowable subject matter in claims 7, 8, 10, 17 and 22. However, Applicant believes that the independent claims and other dependent claims are also allowable over the art of record and defers amending claims 7, 8, 10, 17 and 22 pending prosecution of the remaining rejections.

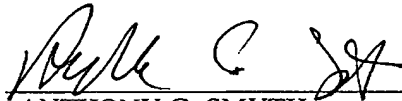
CONCLUSION

Based at least upon the foregoing Remarks, Applicants respectfully submit that all the pending claims are allowable, and that the present application is currently in condition for allowance. The Examiner is encouraged to contact the undersigned at 858-509-4007 if it is believed that a discussion may advance the prosecution of this case.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

Respectfully submitted,

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A handwritten signature in dark ink, appearing to read 'Anthony G. Smyth', is written over a horizontal line.

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